

Elephant Necropsy Protocol

(Elephas maximus and Loxodonta africana)

The American Zoo and Aquarium Association
Elephant Species Survival Plan
and
The Elephant Research Foundation

Revised 1997

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Introduction

This protocol is a cooperative effort of the Elephant Species Survival Plan (SSP) Propagation Group of the American Zoo and Aquarium Association (AZA) and the Elephant Research Foundation (ERF). Its purpose is to provide a format for the systematic collection of information and samples that will add to our knowledge of elephants. All North American institutions holding elephants will have received a copy.

We hope that most institutions will not have to face the immense task of performing an elephant necropsy, but should a death occur, it should be viewed as an important learning opportunity. Although it may not be feasible to collect all the information and samples requested, we encourage the collection of as much as possible.

The *Search List* describes those parts of the anatomy for which data is lacking or about which previous observations need to be confirmed or refuted. The *Measurements Checklist* may seem tedious, but only this type of attention to detail will allow us to expand our knowledge of elephant anatomy. Both of these requested data sets are optional.

Acquainting oneself with the protocol and having the necessary equipment ready will facilitate sample collection. It is suggested that a necropsy team be designated in advance; the ability to mobilize skilled individuals quickly will save valuable time particularly in the event of a sudden death. Veterinarians, anatomists, and pathologists from nearby universities may be enlisted to assist the institution's staff. In addition, a list of researchers interested in participating in elephant necropsies is included in this protocol.

A revised *Research Request List* will be forwarded periodically as new requests are received and projects end. Contact Susan Mikota for current requests. A copy of the completed protocol together with the histopathology and any other lab reports should be forwarded to Dr. Mikota.

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Equipment Checklist

1. Standard large animal necropsy instruments. Multiple scalpel handles, duplicates or triplicates of other instruments. Extra box of scalpel blades, knife sharpener.
2. Retractors of various sizes and shapes. Self-retaining retractors with one or two movable arms mounted on a slide bar are most useful.
3. Sterile instruments for culture collection.
4. 10% neutral buffered formalin.
5. 10% glutaraldehyde (for electron microscopy).
6. Containers for sample collection.
7. Culture swabs, sterile urine cups, glass slides.
8. Serum tubes for blood and urine collection.
9. Aluminum foil and plastic bags for freezing tissues.
10. Labels and waterproof marking pens.
11. Scale for obtaining organ weights.
12. Tape measure (metric), at least 2 meters long.
13. Chain saw and axe to cut through the cranium. Hammers, chisels and hand saws.
14. Hoist/crane.
15. Carts on rollers to move heavy parts.
16. Coveralls, boots, gloves, caps, masks, protective eye and head gear.
17. Accessible water supply with hose.
18. Camera and film, extra batteries.
19. First aid kit.

Logistics and Necropsy Tips

Heavy equipment may be necessary to move a dead elephant. For an on site necropsy, chains and a tow truck may be sufficient to reposition the animal or to move it a short distance. If the animal must be transported to a remote site, a truck with a hoist will be needed. It may be easier to manipulate the animal onto a flatbed trailer. Vehicles must be able to handle these approximate weights: female Asian: 2,300 - 3,700 kg; male Asian: 3,700 - 4,500 kg; female African: 2,300 - 4,000 kg; male African: 4,100 - 5,000 kg. Trucks can generally be rented from equipment rental companies, or may be available from the telephone company. If a flatbed carrier is used the animal will need to be strapped to the bed and covered with a tarp (a baseball diamond infield tarp works well). If transportation will be delayed, the carcass can be covered with ice.

If death is imminent or euthanasia is planned, completion of the measurement checklist antemortem will save time at necropsy. Otherwise, measurements should be done as soon after death as possible.

Assigning specific tasks to team members will help the necropsy to proceed in an orderly manner. For example, a team may be assigned to each of these areas: head, forelegs, hindlegs, abdominal region. One person should oversee the collection, labeling, and processing of research materials and any communication concerning research request. It may be helpful to designate a media spokesperson.

Dissection of the head is best completed after separating it from the body. A good portion of the cranium must be damaged to remove the brain intact; a chain saw, large axe, and chisels are needed to penetrate the thick cranium. A posterior approach to brain removal can be made by 3 connecting deep cuts with a chain saw in the margins of the flattened triangle formed at the base of the elephant skull. Then remove the bony plate in chunks with a curved crow-bar. Use of a chain saw on bone can be hazardous and cause shrapnel-like fragments to be launched. Protective head and face gear should be worn by the chain saw operator and attending personnel removed from the immediate area.

Dissection of the thoracic cavity is best performed by at least two people. After the initial incision at the ventral midline is made, one person holds the retractor and the other cuts the tensed skin. Once the sternum is exposed, the ribs are separated at the cartilaginous attachment and adjustable retractors are applied to hold the cavity open. The heart, lungs, and associated structures may be removed "en bloc" with the diaphragm. Visceral and parietal pleura are normally adhered; there is no pleural space.

SSP Elephant Necropsy Protocol Gross Examination Worksheet

Institution/Owner _____

Address _____ Country _____

Species _____ Id# _____ Isis# _____ Studbook# _____

Birth Date/Age _____ Sex _____ Weight (KG) _____ (Actual/Estimate)

Death Date _____ Death Location _____

Necropsy Date _____ Necropsy Location _____ PM Interval _____

Captive Born ☐ _____ Wild Caught ☐ _____

History (Include clinical signs, circumstances of death, clinical lab work, diet & housing)

GROSS EXAMINATION

(If no abnormalities are noted mark as normal or not examined (NE); use additional sheets if needed)

General Exam (Physical and nutritional condition, pelage, sq. fat stores, body orifices, superficial lymph nodes)

Musculoskeletal System (Bones, marrow, joints, muscles)

Body Cavities (Fat stores, pleura, thymus, lymph nodes)

Spleen

Respiratory System (Nasal passages, pharynx, larynx, trachea, bronchi, lungs, regional lymph nodes)

Cardiovascular System (heart, pericardial sac, great vessels, myocardium, valves, chambers)

Digestive System (mouth, teeth, tongue, esophagus, stomach, small intestine, cecum, large intestine, anus, liver and gallbladder, pancreas, mesenteric lymph nodes)

Urinary System (kidneys, ureters, bladder, urethra)

Reproductive System (testes/ovaries, uterus & cervix, penis/vagina, urogenital canal, accessory sex organs, mammary gland, placenta)

Endocrine System (thyroids, parathyroids, adrenals, pituitary)

Central Nervous System (brain, meninges, spinal cord)

Sensory Organs (eyes, ears)

Additional Comments or Observations:

Prosector: _____ Date: _____

Summarize Preliminary Diagnoses:

Laboratory Studies: Results of cytology, fluid analysis, urinalysis, serum chemistries, bacteriology, mycology, virology, parasitology, x-ray, photography, other _____.

Measurements (Optional)

This data sheet is a general guideline to the pre-euthanasia or post mortem measuring of an elephant. Refer to the anatomical diagrams, Figures 1 and 2. The numbering system begins at the trunk and continues in a clockwise direction. All measurements should be taken in a straight line, except when indicated otherwise. Measurements to be taken between corresponding points on opposite sides of the body are marked with a plus symbol (+). These should be taken in a straight line, essentially through, not around, the elephant. Calipers can be improvised from two long straight poles or straight edges. Place the end of each pole on one of the two points, keeping the poles parallel to one another. Measure the straight line distance between the free ends of the two parallel poles.

GENERAL			
Subject		Reference numbers on figures	Measurement between these points (cm)
Tip of trunk to tip of tail (along the curve)		Fig. 1: 1-9	
Length of trunk (along the curve)		Fig. 1: 1-2	
Length of tail		Fig. 1: 8-9	
Shoulder height		Fig. 1: 5-14	
Dorsum height (the highest point of back or "hump")		Fig. 1: 6-13	
DETAILED			
TRUNK	Tip to base length	Fig. 1: 1-2	
	Tip width	Fig. 1: 1-21	
	Base width	Fig. 1: 40+	
HEAD	Dorsal length (along the curve)	Fig. 1: 2-3	
	Ventral length (along the curve)	Fig. 1: 19-20	
	Neck height	Fig. 1: 3-19	
	Width between ears	Fig. 1: 38+	
	Width between temporal glands	Fig. 1: 38a+	
	Width between eyes	Fig. 1: 39+	
	Width of mouth	Fig. 1: 40+	
EAR	Anterior width	Fig. 1: 22-23	
	Posterior width	Fig. 1: 24-25	
	Dorsal length	Fig. 1: 22-24	
	Ventral length	Fig. 1: 23-25	

Subject		Reference numbers on figures	Measurement between these points (cm)
NECK	Length	Fig. 1: 3-4	
	Width	Fig. 1: 37+	
	Height	Fig. 1: 3-19	
BODY	Dorsal length (along the curve; number 7 is in a straight line with number 11)	Fig. 1: 4-7	
	Middle length (make sure this and the next measurement are taken parallel to each other)	Fig. 1: 32-26	
	Bottom length (make sure this and the previous measurement are taken parallel to each other)	Fig. 1: 10-27-18a	
	Width at front	Fig. 1: 36+	
	Width at middle	Fig. 1: 35+	
	Width at back	Fig. 1: 34+	
	Height at front of forelimb	Fig. 1: 5-27	
	Height at front of hindlimb	Fig. 1: 6-30	
	Height at back of hindlimb	Fig. 1: 7-10	
TAIL	Length (excluding hairs)	Fig. 1: 8-9	
	Width at base	Fig. 1: 8-33	
FORELIMB	Length (height)	Fig. 1: 16-26	
	Width at top	Fig. 1: 18b-28	
	Width at bottom (include side width, if different)	Fig. 1: 15-17	
HINDLIMB	Length (height)	Fig. 1: 11-31	
	Width at top	Fig. 1: 29-31	
	Width at bottom (include side width, since it is narrower)	Fig. 1: 11-12	

Subject		Reference numbers on figures	Measurement between these points (cm)
FEET	Count number of "toenails"		Left front
			Right front
			Left hind
			Right hind
TEETH (can be measured soon after death or at a later date)	Total number of plates (including very small ones)	Figure 2a: (see 1b)	
	Total length	Fig. 2a: 1	
	Maximum width	Fig. 2a: 3 (see 1a)	
	Maximum grinding length of individual teeth	Fig. 2a: 1a	
	Maximum grinding length of entire grinding surface	Fig. 2a: 1b	
	Maximum height	Fig. 2a: 2	
	Weight (in grams)		
TUSKS	Present _____ Absent _____	Figure 2b	
	Length from tip to gum line	Fig. 2b: b-c	
	Length from gum line to base	Fig. 2b: a-c	
	Length of pulp cavity	Fig. 2b: a-d	
	Width of pulp cavity	Fig. 2b: e-e	
	Total length	Fig. 2b: a-b	
PENIS	Circumference at base		
	Circumference at head		
	Length		
CLITORIS	Circumference at base		
	Circumference at head		

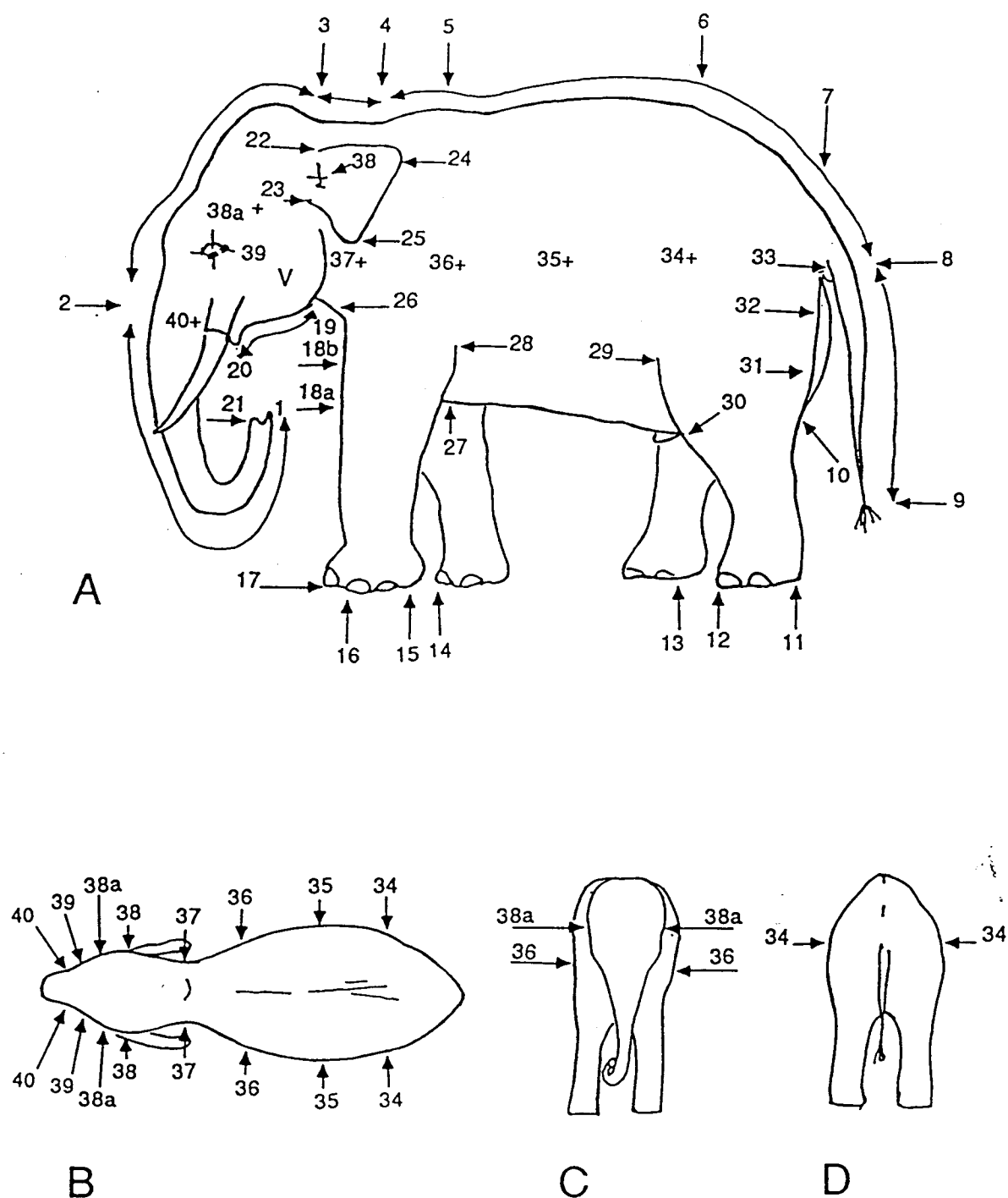


Figure 1. Generalized illustrations of an elephant showing points for measurement; a) after Deraniyagala (1955); all others by Shoshani. Letter "V" on the head indicates the approximate location of the vent gland.

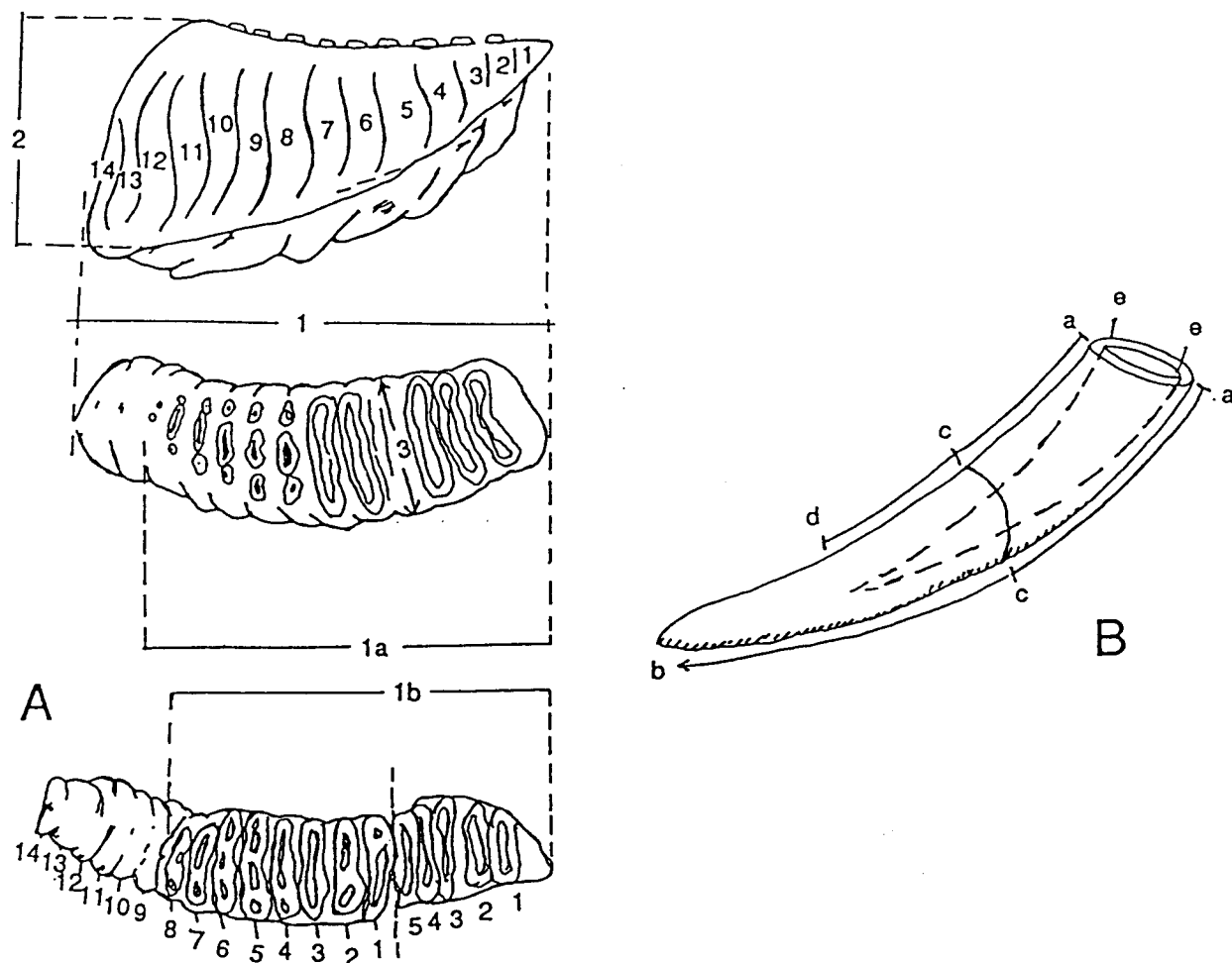


Figure 2. Generalized illustrations of the teeth and tusk showing points for measurement. After Roth and Shoshani (1988).

Search List (Optional)

The following are anatomical features that need to be confirmed or refuted, or for which few data exist. They are not arranged in order of importance, but rather as one studies the elephant by regions from the tip of the trunk to the tip of the tail. Please be aware of these anatomical questions and attempt to obtain the needed additional data as you proceed in your dissection.

1. Record the **number of toes**.
2. **Weigh skin** after dissection from limbs and carcass. Optional.
3. Search for **sesamoids** especially under tendons. There may be one at the proximal end of the humerus, but check other sites as well.
4. Obtain **total skeletal weight**. Remove as much soft tissue as possible.
5. Note any **pathological conditions in the joints**. Slight erosions on articular surfaces can be viewed best in fresh tissues and should be examined soon after death. Grooves and fractures on articular surfaces cannot be mistaken and should be sought. Look also for "joint mice," calcium deposits, and any other abnormal signs.

6. Measure the **volume of the nasal passages** by instilling water soon after death or by measuring the diameter of the passages at intervals (record total length of trunk and diameter of passages at intervals of 10 cm).
7. Look for the **intercommunicating canal between the two nasal passages** of the trunk and the associated fibrous arches by sectioning the trunk every 10-20 cm. These structures were described as being located 13 cm from the tip of the trunk in a young female Asian elephant. Other searches in adult Asian females have revealed neither the arches nor the canals (Shoshani *et al.*, 1982).
8. Harvest the **lenses** from the eyes and weigh them (or keep intact eyes frozen).
9. Search for the **trachea-esophageal muscle**. This muscle is small and may be overlooked or cut during dissection so we suggest that a section about 20 cm posterior and 50 cm or more anterior to the bifurcation be removed and examined carefully outside the carcass. This muscle was found in only three of twelve elephants examined (Shoshani *et al.*, 1982).
10. Examine the **dividing arrangement of the arteries from the aortic arch**. There are two possibilities: three branches or two branches. In the three-branch arrangement the sequence is right subclavian, a trunk common to the two carotids and the left subclavian. In the two-branch arrangement, the right subclavian and the common carotids merge into one vessel and the left subclavian remains separate.

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Researchers Interested in Participating in Necropsy Procedures

The following researchers may be available to participate in necropsies. If you are interested, please contact them as soon as possible after an animal dies or before euthanasia.

Name	Work Number	Home Number	Fax Number
William A. Akerston, Pocatello, Idaho, USA	(208) 236-4151		(208) 236-4600
D. J. Hillman, Baton Rouge, Louisiana, USA	(504) 346-3246	(504) 272-0156	(504) 346-3329
Vaughan A. Langman Shreveport, Louisiana, USA email: 75554,3044@compuserv.com	(318) 797-5244	(318) 798-2750	(318) 797-5156 (318) 227-1141
Susanne J. Miller, Pocatello, Idaho, USA	(208) 526-0938	(208) 529-2453	(208) 236-4600
L. E. Rasmussen, Beaverton, Oregon, USA	(503) 690-1263	(503) 621-1435	(503) 690-1464
Jeheskel (Hezy) Shoshani, Bloomfield Hills, Michigan, USA	(810) 540-3947	(810) 540-3947	(810) 540-3948

Research Requests

- Dr. Jeheskel (Hezy) Shoshani
Elephant Research Foundation
Department of Biological Sciences
Wayne State University
Detroit, Michigan 48202
Work: (313) 577-1757
e mail: jshosh@sun.science.wayne.edu

Entire fetus or newborn or measurements and photographs of fetus or newborn (Anatomical Studies)
Freeze fetus or preserve in 10% formalin. If entire fetus cannot be obtained, photographs and measurements of teeth are particularly needed.

Intact brain (Anatomical Studies) from any age, sex or species of elephant. Preserve in 10% formalin.

2. Dr. Bets Rasmussen
Associate Professor of Chemistry
Oregon Graduate Institute
20000 NW Walker Rd
Beaverton, Oregon 97006

e-mail betsr@admin.ogi.edu
phone
home: 503-621-1435
work: 503-690-1263
Fax : 503-690-1464

For any MALE ASIAN (and or AFRICAN) ELEPHANT please call Bets Rasmussen immediately at 503-690-1263 or 503-621-1435. She will come on the next airplane as certain tissues are of extreme and immediate value in her studies.

Vomeronasal organ (Chemical sense studies; electron microscopy). See diagrams A and B.

Adults: Only the incisive ducts are requested. These paired openings on the roof of the mouth are 1-2 cm in diameter, several cms posterior to the juncture of the mucosa of the mouth with the lip region. The incisive ducts (ID) are indicated by the white arrows diagram B. You are looking down at the roof of the mouth with the upper teeth toward the bottom of the photograph. The vomeronasal organ proper is located in the region indicated by the white "BELOW" on diagram B.

Fetal, neonates & young elephants: The whole organ is requested. It is found in the vomer bone, dorsal and posterior to the incisive ducts. It is paired and eventually each half becomes tubular in shape, and is surrounded by a cartilage sheath. In immediately post-natal elephants the incisive ducts are discontinuous with the actual vomeronasal organ and the organ is less tubular. In these young elephants one way to obtain the organ is to work dorsal/posterior from the ducts, looking for shiny white cartilage surrounding receptive tissue, which is hollow in the center.

Fixatives: Preferred fixative is 4% buffered paraformaldehyde or 2% glutaldehyde in a pH 7.2 buffer. Pieces should be **VERY SMALL** (1mm x 1mm x 1 mm) for EM material. Investigator will ship pre-made fixative upon request. If those two fixatives are not available, fix in buffered 10% formalin and use larger pieces. Save (in formalin) the larger section from which the EM piece was taken. **EXTRA VNO TISSUE SHOULD BE FROZEN IN LIQUID NITROGEN IF POSSIBLE IN 1CM X 1CM X 2CM PIECES, FOR BOTH ADULT AND YOUNG ELEPHANTS.**

Palatal pits: (Histological and cytological studies) The palatal pits are a dual series of small openings (0-13), asymmetrically and bilaterally located along the approximate demarcation line in the upper head between the hard palate and the trunk. Push aside the upper lip to locate. They are smaller than the incisive openings. Their location is indicated by PP on diagram B.

Trunk tip finger(s): (Chemical sense studies) Both EM fixed (very small pieces & special fixative, see VNO section) and formalin fixed pieces of the dorsal trunk tip finger and corresponding ventral "heel" of Asians and the dorsal and ventral opposing tips of Africans of ALL ages, especially young and fetal elephants are requested. Especially to be fixed are pieces including the small invaginations.

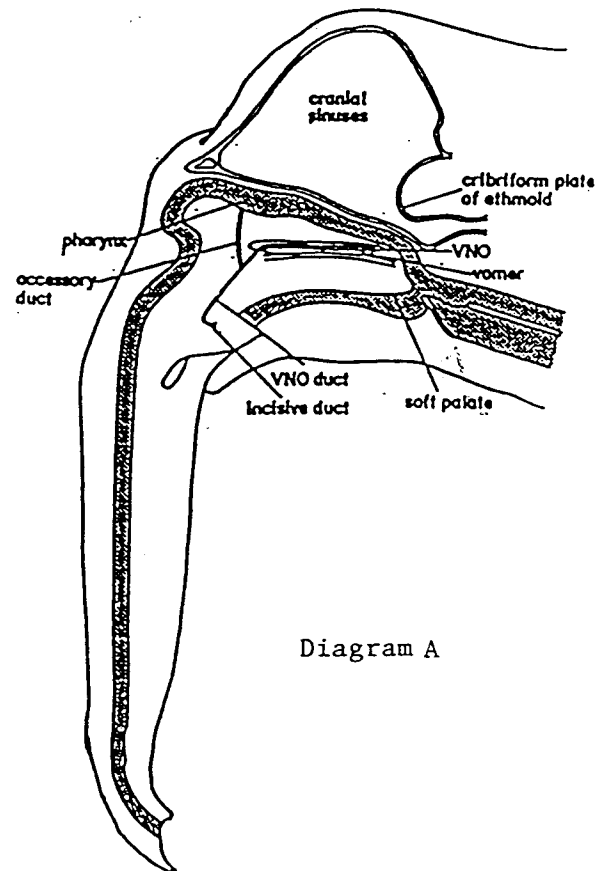
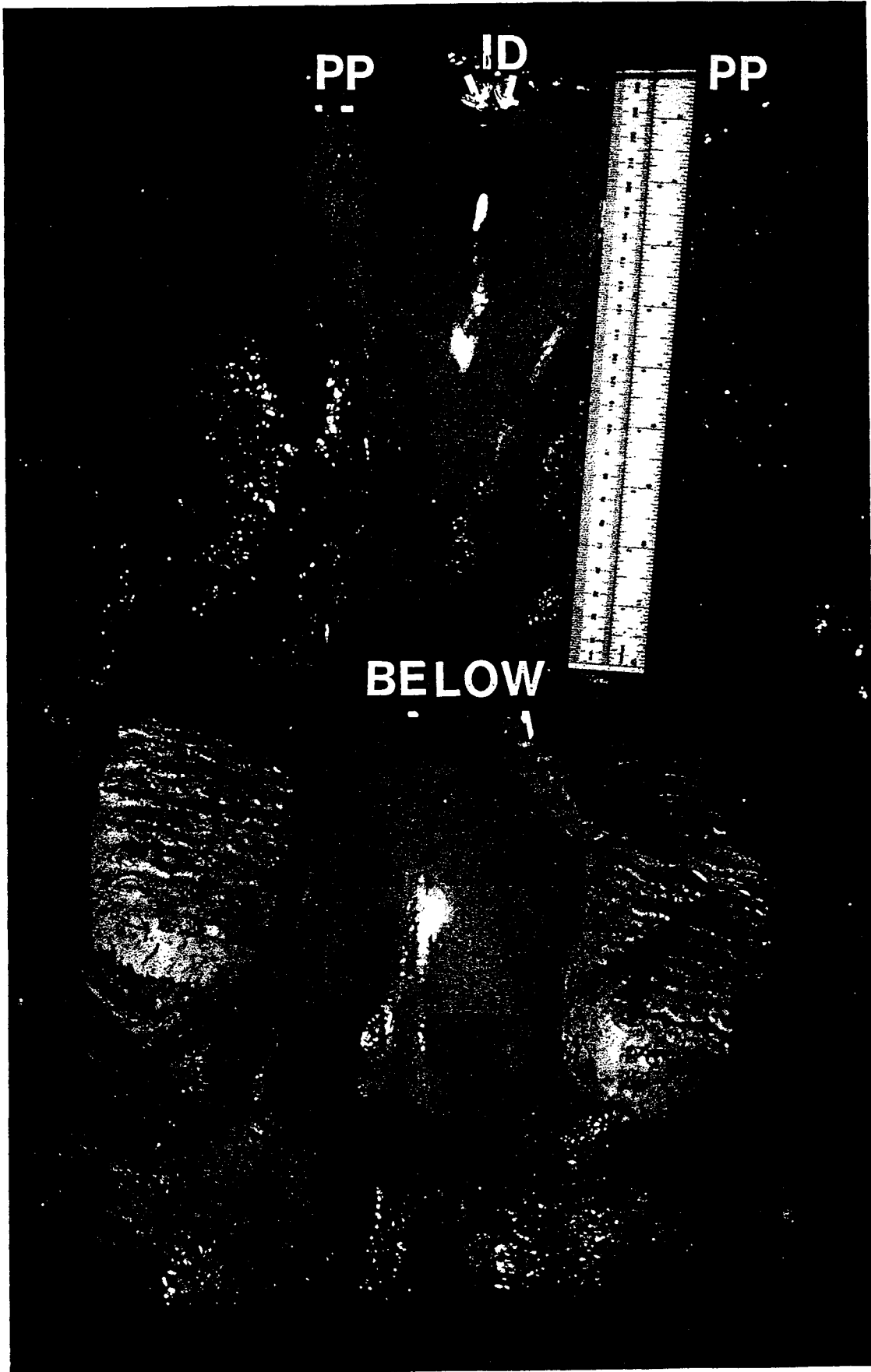


Diagram A

Diagram B



-
3. Dr. C. Earle Pope
Audubon Center for Research of Endangered Species
14001 River Road
New Orleans, Louisiana, USA 70131
Work: (504) 398-3161
Home: (504) 734-5381
Fax: (504) 391-7707
email: epope@acres.org

Intact ovaries (To recover oocytes for in-vitro maturation and culture) Remove ASAP; rinse with saline to remove blood and adhering tissue. Wrap in sterile gauze pre-soaked in saline and place in plastic bag or specimen container. Keep at room temperature if sample can be shipped the same day; if longer pack in crushed ice. Ship overnight; will pay shipping.

4. Vaughan A. Langman Ph.D.
LSU in Shreveport Department of Biological Sciences
8515 Youree Drive
Shreveport, Louisiana, USA 71115
Work: (318) 797-5244
Home: (318) 798-2750
Fax: (318) 797-5156
Or
Dr. D. J. Hillman
Louisiana State University
Department of Veterinary Anatomy
School of Veterinary Medicine
Baton Rouge, Louisiana, USA 79803
Work: (504) 346-3246 / 346-3164
Home: (504) 272-0156
Fax: (504) 346-3329

Intact head, neck and ears with cervical vertebrae if possible (To study venous drainage) Contact prior to necropsy. Will pay shipping.

5. Dr. Larry Agenbroad
The Mammoth Site
1800 Hwy 18 By-pass
Hot Springs, South Dakota, USA 57747
Work: (605) 745-6017
Fax: (605) 523-2626

Skeletal remains; Asian or African (Exhibit; comparative collection) Rough flesh if possible and ship frozen or just freeze. Will pay shipping.

-
6. Dr. William A. Akerston
Curator of Vertebrate Paleontology
Idaho Museum of Natural History
Campus Box 8096
Pocatello, Idaho, USA 83209
Work: (208) 236-4151 / 236-3168
Home: (208) 232-5436
Fax: (208) 236-4600

Or

Susanne J. Miller
1450 Antares Drive
Idaho Falls, Idaho, USA 83402
Work: (208) 526-0938
Home: (208) 529-2453
email work: ski@inel.gov
email home: olbonz@srv.net

Complete or partial juvenile skeleton (Aid identification of fossil mammoths for comparative osteology collection) Bones must be rough-fleshed and dried to avoid spoilage during shipping. Will pay shipping costs and labor for rough-fleshing.

7. Dr. Linda Munson
Department of Veterinary Pathology, Microbiology Immunology
University of California
School of Veterinary Medicine
Davis, CA 95616
Work: (916) 752-1385

Sections of uterine endometrium (Characterization of endometrial lesions) Endometrial samples including any polyps, cysts, tumors or other lesions. Samples should include lesion and adjacent normal tissue. Fix in 10% formalin. Ship by U.S. mail. Will pay shipping.

8. Jenifer Lienau or Carla Bitter
Arizona Science Center
600 E. Washington Street
Phoenix, Arizona, USA 85004
Work: (602) 716-2000
Fax: (602) 716-2088

Elephant bladder with ureters and urethra attached. (For museum display) Store in electrolyte solution or 10% saline and freeze in expanded position. Ship frozen, overnight on dry ice. Will pay shipping.

-
9. Robert L. Van Critter, M.D.
 Professor of Medicine
 Physiology and Biophysics
 University of Washington School of Medicine
 Mail: RG-22
 University of Washington School of Medicine
 Seattle, Washington, USA 98105
 Shipping: University of Washington Cardiology
 1959 NE Pacific Room E-303
 Seattle, Washington, USA 98105
 Work: (206) 543-9952
 Home: (206) 774-1770
 Fax: (206) 543-3639

Cross sections of coronary arteries. (For comparative circulation studies) Take a) 2 pieces, 1 cm in length of right or left main coronary artery; b) 2 pieces of tertiary branch of either coronary artery. Place in formalin and ship by common carrier. Will pay shipping.

10. David Combs, Ph.D.
 California Museum of Science and Industry
 Director's Office
 700 State Drive
 Los Angeles, California, USA 90037
 Work: (213) 744-7547
 Home: (818) 791-5404
 Fax: (213) 744-2034

Intact Adult Indian or African elephant heart. (For comparative mammalian blood volume and relative heart sizes museum display) Excised heart must be intact, preferably not opened, leaving 4" or 5" of the aorta and vena cavae as well as 2" of the pulmonary vessels. Pack in ice and ship overnight. Will pay shipping.

11. Drs. Dick Montali and Laura K. Richman
 National Zoological Park, Department of Pathology
 3001 Block of Connecticut Avenue, NW
 Washington, DC, USA 20008-2598
 Work: (202) 673-4869
 Home: (301) 926-2622 (RJM); (301) 253-8723 (LKR)
 Fax: (202) 673-4660

1. Complete set of formalin fixed tissues (as per SSP Necropsy Protocol) 2. Ultra frozen (-70°C) heart, liver, tongue, spleen, intestinal or oral ulcers. 3. Whole blood (20 cc); serum (20 cc). 4. 20 cc urine. (For elephant herpes virus study) For formalin fixed tissues .5 - 1.0 cm thick sections. Take samples to be frozen as soon as possible - place in sterile container and freeze. Send frozen tissue overnight on dry ice. Send blood and urine samples overnight on wet or dry ice. Call before shipping. Will pay shipping.

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12. Dr. Dick Montali / Dr. Jamie Brown
National Zoological Park, Department of Pathology
3001 Block of Connecticut Avenue, NW
Washington, DC, USA 20008-2598
Work: (202) 673-4869
Home: (301) 926-2622
Fax: (202) 673-4660

1. Sections of uterine leiomyoma. 2. Sections of normal uterine wall. 3. Serum sample (2-3 ml). (For comparative study of nuclear receptors and estrogen receptors in tumored and normal uterus with human and guinea pig models to identify non GnRH analogs to reverse tumors) Need 2-3 representative sections of leiomyomas and normal uterine wall approximately 1-2 cm thick. Fix 1 set in 10% neutral buffered formalin. Freeze a replicate set in liquid nitrogen or "Revco" ultra freezer at -70°C. Send frozen samples overnight on dry ice. Will pay shipping. Call for billing number. Please include brief reproductive history.

13. Anthony T. Boldurian, Ph.D.
Associate Professor Anthropology
University of Pittsburgh at Greensburg
Smith Science Building
1150 Mr. Pleasant Road
Greensburg, Pennsylvania, USA 15601
Work: (412) 836-9989
Fax: (412) 836-7129

Two whole large thoracic ribs. (For experimental archeological study to replicate mammoth shaft wrench artifact) Minimum width 60 mm; minimum thickness 20 mm. Samples must be in a "green" or unweathered state, preferably from a recently deceased individual. Pack in ice if tissue still adhering. Call before shipping. Will pay shipping.

14. Dr. Ellen Dierenfeld
Wildlife Conservation Society
185 th Street and Southern Blvd.
Bronx, NY 10460
Work: (718) 220-7102
Home: (718) 885-0402
Fax: (718) 220-7126
Email: edierenfeld@wcs.org

Liver, adipose tissue, skeletal muscle, heart. (Baseline data collection on fatty acids, minerals and vitamin concentrations in tissues for comparative purposes.) Take 5 gram samples of each tissue, trim and place in individual plastic bags labeled with the animal's identification, institution, date and tissue. Freeze. Ship on dry ice in hot months, wet ice in cold months in a well-insulated container, overnight. Call for shipping account number.

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15. Mark Prausnitz
Gerogin Institute of Technology
School of Chemical Engineering
Atlanta, GA 30332-0100
Work: (404) 894-5135
Home: (404)92-4597
Fax: (404) 894-2866
Email: mark.prausnitz@che.gatech.edu

Skin. (To study the effects of electric fields on skin from large land mammals as a method to increase delivery of drugs across the skin.) Take full thickness skin samples 12" X 12" from the back, abdomen and chest. Submit 2 - 3 pieces from each site. Skin should have as little hair as possible and not be physically damaged. Animal should be older than 1 year with no known skin diseases. If cadaver is stored refrigerated, skin should be removed within 1 week post mortem. If the cadaver is unrefrigerated, skin should be removed within 1 day. Store the skin frozen, preferably at -60° to -90°C , a conventional freezer is also acceptable. Skin can be stored frozen for up to a week before shipping. Label site and place samples in individual zip-lock bags. Ship in a styrofoam container on dry ice overnight. Will pay shipping.